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**Title**

Attitude Toward Own Aging Among Older Adults: Implications for Cancer Prevention.

**Permalink**

<https://escholarship.org/uc/item/4v51j299>

**Journal**

The Gerontologist, 59(Suppl 1)

**ISSN**

0016-9013

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**Publication Date**

2019-05-01

**DOI**

10.1093/geront/gnz039

Peer reviewed

## Research Article

# Attitude Toward Own Aging Among Older Adults: Implications for Cancer Prevention

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Received: July 5, 2018; Editorial Decision Date: February 27, 2019

**Co-decision Editors:** Richard A. Goodman, MD, JD, MPH; Dawn M. Holman, MPH; and Mary C. White, ScD

## Abstract

**Background and Objectives:** Negative age stereotypes can become internalized and contribute to lower levels of physical and mental well-being in older adults, including those with serious illnesses. The main objective of this study was to examine the relationships of attitude toward own aging (ATOA) with health outcomes after controlling for resilience among older cancer survivors and comparison subjects without cancer, aged 50 years or older.

**Methods:** We examined data in 1,140 adults from the Successful Aging Evaluation (SAGE) study, a structured multi-cohort investigation of community-based adults selected using random digit dialing. There were 219 participants with cancer (excluding skin cancer) and 912 without cancer. ATOA was assessed with the Philadelphia Geriatric Morale Scale, and its relationship with measures of physical, cognitive, and mental health, as well as resilience was evaluated.

**Results:** Individuals with cancer reported slightly more pessimistic ATOA than individuals without cancer. ATOA correlated with physical and mental health in individuals with and without cancer. Hierarchical linear multiple regression revealed that ATOA contributed significantly to the prediction of physical and mental health after controlling for socio-demographic variables and resilience.

**Discussion and Implications:** Higher levels of positive ATOA appear to be a protective factor for health in older adults, including those with cancer. Interventions that provide education about positive aspects of aging, modify negative automatic thoughts, and promote optimism may be useful for increasing ATOA and thereby improving physical and mental health in older adults, especially those with cancer.

**Keywords:** Ageism, Successful aging, Resilience, Well-being, Cognition, Disability

Ageism, defined as discrimination against and stereotyping of persons based on their age (Swift, Abrams, Lamont, & Drury, 2017), is a highly impactful experience for older adults. Negative stereotypes of aging include beliefs that older adults are unproductive, absent-minded, reluctant to learn and change, uninterested in intimacy, and lacking energy (Berger, 2017). These negative stereotypes often

obscure positive perceptions of aging in which older adults are seen as wise, approachable, charitable, moral, loyal, experienced, and reliable (Swift et al., 2017).

Aging stereotypes can become internally directed over time, informing one's attitude toward own aging (ATOA). ATOA refers to the expectations, cognitive representations, and perceptions of individuals regarding their own aging

process (Kavirajan et al., 2011; Levy, 2009; Westerhof & Wurm, 2015). Among adults over age 50, a more positive ATOA is associated with better physical health and functioning (Bryant et al., 2012; Meisner, 2012; Sargent-Cox, Anstey, & Luszcz, 2012; Tovel, Carmel, & Raveis, 2019; Warmoth, Tarrant, Abraham, & Lang, 2016), memory and cognitive functioning (Siebert, Wahl, & Schröder, 2018; Warmoth et al., 2016), and mental health (Bellintier & Neupert, 2018; Bryant et al., 2012; Warmoth et al., 2016), including higher levels of self-efficacy (Tovel et al., 2019) and resilience (Kavirajan et al., 2011) as well as longer lifespan (Levy, Slade, & Kasl, 2002). On the other hand, considerable research has also highlighted the potentially harmful impact of negative ATOA on physical health among individuals with chronic illnesses such as heart disease and diabetes. In these populations, ATOA has been associated with greater perceived health problems, worse health maintenance practices, greater functional limitations, and higher likelihood of mortality at 2- to 2.5-year follow-up (Stewart-Knox et al., 2012; Wolff, Schütz, Ziegelmann, Warner, & Wurm, 2017).

Levy and colleagues have explored mechanisms by which ATOA might affect health. These authors found that negative ATOA amplified stress whereas positive ATOA protected against stress (Levy, Hausdorff, Hencke, & Wei, 2000). Levy's (2009) Stereotype Embodiment Theory suggests that aging stereotypes are internalized and become increasingly engrained across the lifespan, generally operating unconsciously and having a direct influence on functioning and health via multiple pathways. In a longitudinal study of survival among adults over age 50, negative ATOA predicted increased levels of a biomarker of cumulative stress-related inflammation (i.e., C-reactive protein), which in turn predicted shorter survival/increased mortality (Levy & Bavishi, 2018). Taken together, this research suggests that ATOA affects physical health through a stress-related pathophysiological pathway.

To our knowledge, no published study has explored the impact of ATOA among older adults with cancer. Cancer is the second leading cause of death in the United States and is much more common in older than younger adults (American Cancer Society, 2017). Unlike many other factors contributing to health and longevity in cancer, psychological attitudinal factors such as ATOA are potentially modifiable, and may thus be excellent targets for interventions aimed at cancer prevention.

One potentially modifiable psychological factor that has been studied among cancer patients is resilience. Resilience refers to the process of positively adapting to adversity through the active use of psychological coping strategies (Fletcher & Sarkar, 2013). Similar to positive ATOA, resilience is believed to improve health outcomes by reducing stress-related responsiveness (Tugade, Fredrickson, & Feldman Barrett, 2004). Among individuals with cancer, resilience is associated with reduced distress, and greater hope, inner strength, and quality of life (as reviewed in Molina et al.,

2014). Interventions aimed at promoting resilience have led to improvements in anxiety, perceived stress, and quality of life (Loprinzi, Prasad, Schroeder, & Sood, 2011).

The current study sought to compare the association of ATOA with physical, cognitive, and mental health among individuals with versus without cancer in the Successful AGing Evaluation (SAGE) cohort. Within SAGE, we have previously explored the impact of resilience and depression on successful aging (Jeste et al., 2013) and differences in physical, cognitive, and mental health among individuals with versus without cancer (Zlata et al., 2015). However, we have never examined the impact of ATOA in older adults with cancer. The conceptual framework guiding this study was that (similar to resilience), positive ATOA would be associated with better physical, cognitive, and mental health outcomes by reducing stress-related responsiveness. This would apply to both cancer and non-cancer groups, but the cancer group would experience worse ATOA and greater stress. While both resilience and ATOA seem to affect health outcomes by reducing stress responsiveness, they represent somewhat distinct psychological processes, with resilience involving an active, adaptive psychological response to adversity, and positive ATOA consisting of a general system of semantic beliefs about the nature of one's own aging. Therefore, we sought to explore the incremental impact of ATOA after accounting for the effects of resilience, to ascertain whether ATOA would be an appropriate intervention target, independent of resilience.

We hypothesized that ATOA would be lower (more negative) among individuals in the cancer group relative to the non-cancer group. Additionally, we hypothesized that ATOA would correlate with physical, cognitive, and mental health as well as resilience and that the magnitudes of these correlations would be similar among cancer and non-cancer groups. Finally, we hypothesized that ATOA would predict levels of physical, cognitive, and mental health independent of resilience, and that resilience and ATOA would exert synergistic effects on health such that higher levels of resilience would enhance the impact of positive ATOA on physical, cognitive, and mental health outcomes in both groups.

## Methods

### Participants and Procedures

Participants were older adults between ages of 50 and 99 years, who were recruited as part of SAGE. SAGE is a study of three different domains of aging—physical, cognitive, and mental/ psychosocial—among community-dwelling adults in San Diego County, selected by random digit dialing (Jeste et al., 2013; Thomas et al., 2016). Participants were English speaking, physically and mentally able to provide informed consent, participate in a phone interview, and complete an annual survey. There was an over-representation of adults in their 80s and 90s, whose numbers in most published studies of aging have tended to be relatively small. We excluded participants residing

in nursing homes or requiring daily, skilled nursing care, or with a diagnosis of dementia or a terminal illness, or receiving hospice care. To be included in this study, participants were required to have complete data on all main variables of interest (i.e., cancer diagnosis, ATOA, resilience, physical health, mental health, and cognitive health), resulting in a sample of 854 participants. This study was approved by the University of California San Diego Institutional Review Board (Protocol #080377 and #171635), and all participants provided informed consent.

### Cancer-Related Variables

A total of 231 participants reported having a diagnosis of cancer. We re-classified 60 individuals who had a diagnosis of skin cancer from the cancer group and combined them with the non-cancer group. Clinically, the treatment and prognosis of most skin cancers (except melanoma and Merkel cell carcinoma) are characteristically much more benign than those of most other cancers. The decision to combine the skin cancer with non-cancer group was informed by prior work (Zlatar et al., 2015) and data in this study. Importantly, in this study, the skin cancer group had closer adjusted sample means (for demographic variables) with the non-cancer group than with the other cancer (specific + nonspecific cancer) group on the four most relevant outcomes in terms of physical and mental health: SF-36 Physical Health Component, SF-36 Mental Health Component, Satisfaction with Life (SWLS) Score, and Happiness (CES-D Happiness Subscale) Score. In addition, inclusion of skin cancer participants in the no cancer group rather than the cancer group had minimal impact on our regression models. Of the remaining 171 persons with cancer included in this study, 23 had breast cancer, 43 had prostate cancer, 12 colon cancer, 6 bladder cancer, and 33 “other” cancer, whereas 54 did not specify the type of cancer. We combined the nonspecific cancer group with the other (specific) cancer group because these two groups had closer adjusted sample means (for demographic variables) than those of the non-cancer group on the same four physical and mental health outcome measures. The mean age at cancer diagnosis was 65 years ( $SD = 16$ ), and the mean number of years since diagnosis was 18 ( $SD = 20$ ). Forty-two percent of these patients reported cancer-related hospitalizations.

### Measures

#### Demographics

Socio-demographic information—age, gender, education, ethnicity, marital status, and household income—was based on self-report.

#### Attitude Toward Own Aging

ATOA was measured using the five-item subscale for attitude toward aging from the Philadelphia Geriatric

Morale Scale (PGMS; Lawton, 1975; Liang & Bollen, 1983). Respondents were asked to indicate whether they agreed or disagreed, with five statements such as “Things keep getting worse as I get older” and “I am as happy now as when I was younger.” Higher scores indicate more positive attitude. Reliability and validity of the PGMS are acceptable (Lawton, 1975).

### Cancer Diagnosis

Participants were asked, “Has a physician ever told you that you have any of the following? (check all that apply and provided year of diagnosis),” followed by a list of 32 medical conditions including cancer. For the cancer option, participants were asked to specify the cancer region, as well as the year of diagnosis.

### Additional Measures

*Physical health* was measured with the physical health component from the Medical Outcomes Study 36-item Short-Form (SF-36; Ware & Sherbourne, 1992).

*Cognitive function* was assessed with the total score on the modified version of the Telephone Interview for Cognitive Status (TIC-M; de Jager, Budge, & Clarke, 2003), which was administered during a telephone interview at the time of enrollment into the SAGE study. TICS-M scores are documented as having good convergent (de Jager et al., 2003) and discriminant (Zlatar, Moore, Palmer, Thompson, & Jeste, 2014) validity.

### Mental health

As we reported previously (Thomas et al., 2016), a mental health composite score was computed by standardizing scores of three positive and three negative psychological attributes, calculating the average value (with negative attributes weighted by  $-1$ ), and then standardizing the outcome. The three measures reflecting positive attributes included the total score on the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985), the total score on the Happiness Subscale (Fowler & Christakis, 2008) of the Center for Epidemiological Studies – Depression (CES-D) scale (Andresen, Malmgren, Carter, & Patrick, 1994); and the mental health component score derived from the Vitality, Social Functioning, Role-Emotional, and Mental Health Subscale scores of the SF-36 (Ware & Sherbourne, 1992). The three negative attributes included total scores on the Brief Symptom Inventory or BSI Anxiety Scale (Derogatis & Spencer, 1993), the Patient Health Questionnaire – 9-item Depression Module (PHQ-9; Kroenke, Spitzer, & Williams, 2001), and the Perceived Stress Scale (J. Cohen, 1988; S. Cohen, Kamarck, & Mermelstein, 1983). The internal consistency of the mental health composite score was high ( $\alpha = 0.87$ ) and variance was dominated by a general factor ( $\omega_h = 0.82$ ) (Thomas et al., 2016).



Resilience was assessed with 10-item Connor–Davidson Resilience Scale, which has been shown to have high reliability and validity (Campbell-Sills & Stein, 2007).

### Analytic Procedures

Initial analyses explored differences across cancer groups on demographic variables, comorbid medical conditions, and measures of resilience and physical, cognitive, and mental health. As part of these analyses, we evaluated our first hypothesis of whether ATOA differed across cancer versus non-cancer groups. Descriptive statistics (proportions for categorical variables and means and standard deviations for continuous measures) were computed and compared between the cancer and non-cancer groups using two-sample *t*-tests or chi-square tests as appropriate.

To evaluate our second hypothesis, Pearson correlations were conducted between ATOA and outcome variables (physical, cognitive, and mental health), as well as our main control variable, resilience. The magnitude of these correlation coefficients was compared between cancer and non-cancer groups using an asymptotic method – Fisher's *z*-test (Tu et al., 2007).

Last, hierarchical linear multiple regression was performed to evaluate our third hypothesis regarding the ability of ATOA to predict physical, cognitive, and mental health outcomes after controlling for demographic variables, other health outcomes, and resilience. Four hierarchical multiple regression models were tested separately to predict physical, cognitive, and mental health. The first model evaluated the extent to which demographic variables (age, education, gender, race/ethnicity, cancer group, and years since cancer diagnosis) predicted health outcomes. We also controlled for non-outcome health measures (e.g., cognitive and mental health when physical health was the outcome) to ensure that regression results were not confounded by general poor health. In the second model, resilience was entered into the regression to evaluate the ability of resilience to predict health outcomes after controlling for demographic variables. In the third step, ATOA was entered into the model. This third model evaluated the extent to which ATOA predicted health outcomes after controlling for demographic variables and resilience. Finally, the fourth model included an interaction term between resilience and ATOA to evaluate whether there was a synergistic effect of ATOA and resilience after controlling for the effects of demographic variables and the main effects of resilience and ATOA. The statistical significance of hierarchically nested models was evaluated using the *F* test and the effect of predictors-of-interest was described in terms of the improvement in explained variance across models (i.e., change in  $R^2$ ). Both resilience and ATOA were centered in the models to facilitate modeling of interaction terms.

## Results

### Participant Characteristics

Individuals in the cancer group were on average older and reported worse physical health than non-cancer participants, although the size of the effect on the latter measure was fairly small ( $d = -0.26$ ) (Table 1). In addition, individuals in the cancer group reported more happiness and better mental health on the SF-36 than non-cancer participants, although again the size of these effects were small ( $d = 0.12$ – $0.13$ ). No other differences in mental health between groups were found, including on the overall mental health composite score. There were no other differences across groups in gender, ethnicity, education, household income, cognitive functioning, or resilience. Notably, individuals in the cancer group reported lower (more pessimistic) ATOA than those in the non-cancer group, although the size of this effect was small ( $d = -0.19$ ).

### Associations of ATOA With Other Variables Among Individuals With Versus Without Cancer

The pattern of correlations among ATOA and health outcomes and resilience was largely similar across cancer and non-cancer groups (Table 2). In both groups, a more positive ATOA was associated with better physical health, mental health, and greater resilience, with the magnitude of these correlations similar across cancer and non-cancer groups. In contrast, ATOA was associated with better cognitive functioning only among the non-cancer group, resulting in a significant difference in the size of the magnitude of this correlation across groups. Although significant, however, the magnitude of this correlation was small among the non-cancer group ( $r = .19$ ).

### Impact of ATOA and Resilience on Physical, Cognitive, and Mental Health

#### Physical health

Table 3 presents standardized beta coefficients,  $R^2$  values, and change in  $R^2$  across successive models predicting physical health. In the first model, demographic and other health outcome variables were significant predictors of physical health,  $F(9, 844) = 25.41$ ,  $p < .001$ , with age, cancer, mental health, and cognitive function significantly contributing to the prediction of physical health. Adding resilience in the second model improved the prediction of physical health,  $F(1, 843) = 13.18$ ,  $p < .001$ , with resilience accounting for an additional 1% of explained variance in physical health. In the third model, adding ATOA again improved the prediction of physical health, even after controlling for resilience,  $F(1, 842) = 198.72$ ,  $p < .001$ , accounting for a substantial 15% of the variance in physical health. Finally, in the fourth model, inclusion of a resilience\*ATOA interaction term did not improve prediction of physical health,  $F(1, 841) = 0.03$ ,  $p = .88$ .

**Table 1.** Participant Characteristics

	Possible range of scores	Cancer ( <i>N</i> = 171)	Non-cancer ( <i>N</i> = 683)	Statistics
		Mean ( <i>SD</i> )	Mean ( <i>SD</i> )	<i>t</i> or $\chi^2$ ( <i>df</i> )
Age (years)	50–99	80.1 (10.9)	76.4 (12.3)	–3.59 <sup>a</sup> (288.8) **
Gender (% women)	—	46.2%	46.4%	0.96 <sup>b</sup> (1.0)
Education (%)				
≤High School	—	21.6%	22.5%	0.93 <sup>b</sup> (2.0)
Some college to bachelor	—	34.5%	31.2%	—
Post-graduate	—	43.9%	46.1%	—
Ethnicity (%)				
Caucasian	—	86.5%	79.4%	5.80 <sup>b</sup> (2.0)
Latino	—	9.4%	11.4%	—
Other	—	4.1%	9.2%	—
Marital status (%)				
Currently Married	—	55.0%	54.2%	0.04 <sup>b</sup> (1.0)
Currently Single	—	45.0%	45.8%	—
Household income (%)				
<\$35,000	—	26.9%	28.4%	0.81 <sup>b</sup> (2.0)
\$35,000–\$74,999	—	30.6%	26.3%	—
\$75,000+	—	42.6%	45.3%	—
Attitude toward own aging (ATOA)	0–5	3.2 (1.6)	3.5 (1.5)	1.97 <sup>a</sup> (852.0) *
Physical health				
SF-36 physical health component	1.7–76.3	41.5 (11.4)	44.4 (10.7)	3.14 <sup>a</sup> (852.0) **
Cognitive function				
Cognitive performance (TICS-m)	0–50	33.0 (5.3)	33.0 (5.3)	–0.08 <sup>a</sup> (852.0)
Mental health				
Mental Health Composite Score	–3 to 3	0.12 (0.9)	0.05 (1.0)	–1.86 <sup>a</sup> (852.0)
Happiness (CES-D)	0–12	10.9 (2.4)	10.6 (2.3)	–1.34 <sup>a</sup> (296.1) **
SWLS score	5–35	26.4 (5.2)	26.4 (5.8)	–0.36 <sup>a</sup> (839.0)
SF-36 mental health component	–1.3 to 80.7	55.9 (8.2)	54.9 (8.2)	–1.45 <sup>a</sup> (852.0) *
Anxiety (BSI)	0–24	1.8 (2.9)	1.9 (2.9)	0.59 <sup>a</sup> (830.0)
Depression (PHQ-9)	0–27	2.4 (3.2)	2.5 (3.5)	0.40 <sup>a</sup> (830.0)
Perceived stress (PSS)	0–40	12.1 (5.6)	12.0 (5.4)	–0.11 <sup>a</sup> (824.0)
Psychosocial function				
Resilience (CD-RISC)	0–40	31.3 (6.7)	31.3 (6.2)	–0.04 <sup>a</sup> (852.0)

Notes: ATOA = Attitude Toward Own Aging; BSI = Brief Symptom Inventory; CD-RISC = 10-item version of the Connor–Davidson Resilience Scale; CES-D = Center for Epidemiological Studies Depression Scale (CES-D); PHQ-9 = 9-item version of the Patient Health Questionnaire; PSS = Perceived Stress Scale; SF-36 = Medical Outcomes Study 36-Item Short-Form Health Survey; SWLS = Satisfaction with Life Scale; TICS-m = modified version of the Telephone Interview for Cognitive Status. *SD* = standard deviation; *df* = degrees of freedom.

<sup>a</sup>*t*.

<sup>b</sup> $\chi^2$ .

\**p* < .05. \*\**p* < .001.

### Cognitive function

As shown in Table 4, in the first model, demographic variables significantly predicted cognitive health,  $F(9, 844) = 44.20$ ,  $p < .001$ , with age, gender, education (both some college and college or more) Hispanic race, Other race, and physical health significantly contributing to this prediction. In total, these demographic variables predicted 31% of the variance in cognitive performance. In the second model, resilience was not found to significantly improve the prediction of cognitive health,  $F(1, 843) = 1.69$ ,  $p = .19$ . Inclusion of ATOA into the model did not improve prediction of cognitive health,  $F(1, 842) = 3.72$ ,  $p = .05$ ,

nor did inclusion of a resilience\*ATOA interaction term,  $F(1, 841) = 0.19$ ,  $p = .66$ .

### Mental health composite score

As presented in Table 5, in the first model, demographic variables were significant predictors of mental health,  $F(9, 844) = 12.49$ ,  $p < .001$ , with age, gender and education (college or more) significantly contributing to this prediction. In the second model, resilience improved the prediction of mental health,  $F(1, 843) = 439.75$ ,  $p < .001$ , accounting for an additional 30% of the variance of mental health outcomes. Entering ATOA in

**Table 2.** Correlations Between Attitude Toward Own Aging and Variables of Interest

	Cancer (N = 171)	Non-cancer (N = 683)	Fisher's z-test
	<i>r</i>	<i>r</i>	<i>p</i> -value
Physical health			
SF-36 physical health component	.53**	.55**	.37
Cognitive function			
Cognitive performance (TICS-m)	.01	.19**	.02*
Mental health			
Mental Health Composite Score	.54**	.57**	.33
Psychosocial function			
Resilience (CD-RISC)	.44**	.46**	.40

Notes: CD-RISC = 10-item version of the Connor-Davidson Resilience Scale; SF-36 = Medical Outcomes Study 36-Item Short-Form Health Survey; TICS-m = modified version of the Telephone Interview for Cognitive Status. *r* = correlation coefficient.

\*Correlation is significant at the .05 level (2-tailed).

\*\*Correlation is significant at the .01 level (2-tailed).

**Table 3.** Standardized Beta Coefficients From Regression Models Predicting Physical Health (*n* = 849)

	Model 1	Model 2	Model 3	Model 4
Individual predictors				
Age	-.30***	-.29***	-.16***	-.16***
Some college <sup>a</sup>	-.02	-.03	-.03	-.03
College degree or greater <sup>a</sup>	.06	.06	.07	.07
Gender <sup>b</sup>	.04	.05	.07	.07*
Hispanic race <sup>c</sup>	.01	.01	-.01	-.01
Other race <sup>c</sup>	.03	.03	.02	.02
Cancer group	-.09*	-.08*	-.06	-.06
Years since cancer diagnosis	.02	.02	.01	.01
Mental health	.25***	.17***	-.09*	-.08*
Cognitive function	.13**	.12**	.12***	.12***
Resilience		.14***	.07*	.07*
ATOA			.50***	.50***
Resilience*ATOA				.18
Overall model				
<i>R</i> <sup>2</sup>	.21***	.22***	.37***	.37***
<i>R</i> <sup>2</sup> change		.01***	.15***	<.001

Notes. ATOA = attitude towards own aging; significance of *R*<sup>2</sup> and *R*<sup>2</sup> change is based on the F-ratio test.

<sup>a</sup>Reference group was high school degree or less.

<sup>b</sup>Reference group was female.

<sup>c</sup>Reference group was non-Hispanic White; Model 1: Physical Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Mental Health + Cognitive Function; Model 2: Physical Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Mental Health + Cognitive Function + Resilience; Model 3: Physical Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Mental Health + Cognitive Function + Resilience + ATOA; Model 4: Physical Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Mental Health + Cognitive Function + Resilience + ATOA + Resilience\*ATOA.

\**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

the model after controlling for demographic variables and resilience further improved the prediction of mental health,  $F(1, 842) = 200.33$ ,  $p < .001$ , explaining an additional 11% of variance in mental health. Finally, the interaction of resilience and ATOA also improved the prediction of mental health,  $F(1, 831) = 60.59$ ,

$p < .001$ . This interaction term explained an additional 3% of variance in mental health. As shown in Figure 1, the negative sign on the interaction term indicated that the effect of ATOA on mental health was diminished at higher levels of resilience relative to lower levels of resilience.

**Table 4.** Standardized Beta Coefficients From Regression Models Predicting Cognitive Function ( $n = 849$ )

	Model 1	Model 2	Model 3	Model 4
Individual predictors				
Age	-.43***	-.43***	-.44***	-.44***
Some college <sup>a</sup>	.13**	.13**	.13**	.13**
College degree or greater <sup>a</sup>	.23***	.23***	.23***	.22***
Gender <sup>b</sup>	-.15***	-.15***	-.15***	-.15***
Hispanic race <sup>c</sup>	-.12***	-.12***	-.12***	-.12***
Other race <sup>c</sup>	-.15***	-.15***	-.15***	-.15***
Cancer group	.05	.05	.05	.05
Years since cancer diagnosis	.01	.01	.01	.01
Physical health	.11**	.11**	.13***	.13***
Mental health	.04	.01	.05	.04
Resilience		.05	.05	.05
ATOA			-.08	-.08
Resilience*ATOA				-.01
Overall model				
R <sup>2</sup>	.31***	.32***	.32***	.32***
R <sup>2</sup> change		.001	.003	<.001

Notes. ATOA = attitude towards own aging; significance of R<sup>2</sup> and R<sup>2</sup> change is based on the *F*-ratio test.

<sup>a</sup>Reference group was high school degree or less.

<sup>b</sup>Reference group was female.

<sup>c</sup>Reference group was non-Hispanic White; Model 1: Cognitive Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Mental Health; Model 2: Cognitive Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Mental Health + Resilience; Model 3: Cognitive Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Mental Health + Resilience + ATOA; Model 4: Cognitive Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Mental Health + Resilience + ATOA + Resilience\*ATOA.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

## Discussion and Implications

To our knowledge, this is the first study to explore ATOA among cancer and non-cancer groups. The findings were partially supportive of our hypotheses. Consistent with our first hypothesis, ATOA was more negative in the cancer relative to the non-cancer group, although the size of this effect was small. In addition, individuals with cancer reported worse physical health than non-cancer participants, but comparable cognitive and mental health. Evaluation of correlates of ATOA across cancer and non-cancer groups largely supported our second hypothesis, as ATOA correlated significantly with physical and mental health as well as resilience across both the cancer and non-cancer group. However, ATOA only correlated with cognitive function in the non-cancer group. Finally, hierarchical multiple regression models revealed that ATOA significantly contributed to the prediction of physical and mental health even after accounting for demographic variables and resilience, and did so to a fairly large extent, accounting for an additional 11%–15% of the variance in these outcomes. In contrast, ATOA did not contribute to the prediction of cognitive function. Findings did not support our hypothesis of a synergistic effect of positive ATOA and resilience, as the interaction between ATOA and resilience was not significant in predicting physical or cognitive health. For mental health, the interaction was

significant, but in the direction opposite of our hypothesis, with ATOA having greater impact on mental health among individuals with lower levels of resilience relative to higher levels of resilience. We believe that the negative interaction between resilience and ATOA was likely due to the fact that both function as protective factors against negative health outcomes. As such, among individuals high in both resilience and ATOA, these protective factors may cancel each other out. In other words, ATOA is likely more important as a protective factor among individuals low in resilience than among individuals with high in resilience because individuals high in resilience already benefit from the positive impact of resilience, and thus, there is less room for improvement in health outcomes among these individuals. This negative interaction is likely most evident in the domain of mental health because the effect sizes of resilience and ATOA are the largest on this health outcome.

These results are largely consistent with the findings of prior studies in people with and without other chronic illnesses. In particular, previous research has also found that positive ATOA is associated with better physical, cognitive, and mental health, as well as higher self-efficacy, lower rates of decline and disability and longer lifespan in the general population of older adults (Bellington & Neupert, 2018; Kavirajan et al., 2011; Levy, 2009; Levy



**Table 5.** Beta Coefficients From Regression Models Predicting Mental Health ( $n = 849$ )

	Model 1	Model 2	Model 3	Model 4
Individual predictors				
Age	.23***	.16***	.20***	.17***
Some college <sup>a</sup>	.10*	.04	.03	.02
College degree or greater <sup>a</sup>	.15**	.10**	.10**	.08*
Gender <sup>b</sup>	.07*	.07*	.09***	.10***
Hispanic race <sup>c</sup>	.04	.05	.02	.01
Other race <sup>c</sup>	-.01	-.01	-.01	-.02
Cancer group	.03	.03	.03	.03
Years since cancer diagnosis	-.004	-.01	-.01	-.01
Physical health	.28***	.12***	-.07*	-.06*
Cognitive function	.06	.01	.03	.03
Resilience		.58***	.43***	.40***
ATOA			.43***	.39***
Resilience*ATOA				-.19***
Overall model				
R <sup>2</sup>	.11***	.41***	.53***	.56***
R <sup>2</sup> change		.30***	.11***	.03***

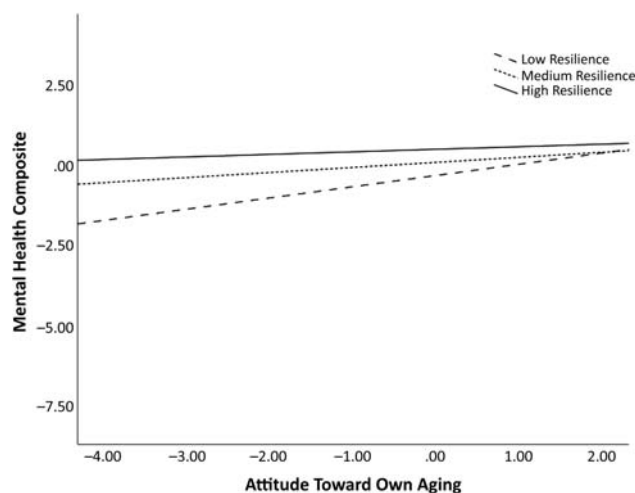
Notes. ATOA = attitude towards own aging; significance of R<sup>2</sup> and R<sup>2</sup> change is based on the *F*-ratio test.

<sup>a</sup>Reference group was high school degree or less.

<sup>b</sup>Reference group was female.

<sup>c</sup>Reference group was non-Hispanic White; Model 1: Mental Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Cognitive Function; Model 2: Mental Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Cognitive Function + Resilience; Model 3: Mental Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Cognitive Function + Resilience + ATOA; Model 4: Mental Health = Age + Some College + College Degree or Greater + Gender + Hispanic Race + Other Race + Cancer Group + Years Since Cancer Diagnosis + Physical Health + Cognitive Function + Resilience + ATOA + Resilience\*ATOA.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .



**Figure 1.** Regression lines predicting mental health from attitude toward own aging at low, medium, and high levels of resilience.

et al., 2002; Meisner, 2012; Siebert et al., 2018; Tovel et al., 2019; Warmoth et al., 2016; Westerhof & Wurm, 2015). Among individuals with chronic diseases, negative ATOA has been shown to be associated with several aspects of physical health, including greater perceived health problems, worse health maintenance practices, and greater functional limitations and higher likelihood of mortality at

follow-up (Stewart-Knox et al., 2012; Wolff et al., 2017). The current study extended this research by exploring ATOA among individuals with cancer. Results indicate that ATOA is associated with physical and mental health, but not cognitive health, to a similar extent across individuals with and without cancer.

The current study also extended previous research by exploring the extent to which ATOA predicted physical, cognitive, and mental health outcomes after controlling for resilience. Resilience is a well-known and highly impactful modifiable psychological factor that has been shown to correlate with various dimensions of mental health among individuals with cancer (Molina et al., 2014). Similar to positive ATOA, resilience is believed to improve health outcomes by reducing stress responsiveness (Tugade et al., 2004). The current study found that the contribution of ATOA to physical and mental health remained significant even after taking into account resilience for both individuals with and without cancer. This suggests that resilience and ATOA affect physical and mental health partly independent of each other. It may be the case that these two psychological processes both affect health outcomes through stress-related mechanisms, but that the pathway by which they affect stress is probably different. This possibility is supported by the distinct psychological processes underlying resilience and ATOA, with resilience

reflecting a more active strategy of coping with adversity and ATOA consisting of a set of semantic beliefs about aging that lead to optimistic or pessimistic expectations. Alternatively, negative ATOA may affect health outcomes through non-stress response pathways, such as reducing motivation for healthy lifestyle maintenance due to beliefs about the inevitability of health declines (Levy & Myers, 2004). Future research should explore the potentially distinct pathways by which resilience and ATOA affect physical and mental health.

Overall, these results suggest that ATOA may be a suitable intervention target to promote physical and mental health among individuals with and without cancer. The impact of ATOA on these health outcomes appears likely to occur independent of any improvement attributable to enhanced resilience. As such, interventions for older adults seeking to improve their well-being should focus not only on cultivating resilience but also on challenging negative age stereotypes and replacing them with positive ATOA.

It is notable that individuals with a history of cancer exhibited similar levels of health on several outcomes investigated in this study. In particular, individuals with cancer exhibited similar mental and cognitive health but worse physical health than individuals without a history of cancer. Moreover, these effects were maintained even after adjusting for age differences across cancer groups. This suggests that in many health domains, individuals with cancer exhibit normal health outcomes, contrary to more pessimistic assumptions of the aging process among cancer survivors.

This study has several strengths including the use of a randomly selected, community-based sample, with an over-representation of adults in their 80s and 90s. In addition, we utilized validated measures of physical, cognitive, and psychosocial functioning. We included both individuals with and without a cancer diagnosis. From the perspective of cancer prevention, cancer survivors are at risk of developing second cancers or a cancer recurrence. Therefore, efforts to reduce cancer risk are of relevance to both groups.

There are also several limitations to this investigation. The cross-sectional nature of these data precludes demonstration of cause-and-effect relationships among specific variables. This was an observational study, and we did not follow participants over time to be able to determine the impact of ATOA with relation to cancer incidence from a prevention perspective. It is possible that worse ATOA in the cancer group could be a direct result of the cancer diagnosis. Future research should explore the longitudinal impact of ATOA and resilience on health outcomes. In addition, the SAGE sample consisted predominately of educated, Caucasian participants and the results may not apply to other groups. Also, it is unclear if the participants with previous cancer diagnosis had a history of lower ATOA (before cancer diagnosis)

or if this is the result of enduring a cancer diagnosis and subsequent treatment. Because the primary focus of the SAGE study was not cancer-specific, we had a relatively small number of participants with cancer (compared to those without), and additional details on diagnosis, course of treatment, and long-term prognosis were not available. Lastly, another limitation of this study is the difference in age between cancer and non-cancer groups, with the cancer group being on average 4.4 years older than the non-cancer group. We adjusted for age in all regression models exploring the effects of ATOA and resilience on health outcomes, which limited the confounding effects of age on relationships among these variables. Nonetheless, the current results could be strengthened by further replication within samples in which cancer and non-cancer groups do not differ in age.

### Clinical Implications for Cancer Prevention

The findings of this study have implications for interventions to improve health outcomes and potentially strengthen cancer prevention in older adults. Overall, our results suggest that ATOA may be a suitable intervention target to promote physical and mental health among individuals with and without cancer. The impact of ATOA on these health outcomes appears likely to occur independent of any improvement attributable to enhanced resilience. As such, interventions for older adults seeking to improve their well-being should focus not only on cultivating resilience, but also on challenging negative age stereotypes and replacing them with positive ATOA.

There is substantial research highlighting the relationship between stress and initiation or progression of cancer through various biological mechanisms (Chida, Hamer, Wardle, & Steptoe, 2008; Kemeny & Schedlowski, 2007; Kruk, 2014; S. Cohen & Herbert, 1996). In a meta-analysis of longitudinal studies, stress-related psychosocial factors were associated with higher cancer occurrence in healthy individuals, as well as decreased survival rates in patients diagnosed with cancer (Chida et al., 2008). Correspondingly, Peled, Carmil, Siboni-Samocho, and Shoham-Vardi (2008) found that women diagnosed with breast cancer were more likely to have experienced two or more negative life events, had significantly higher scores of depression, and lower scores of happiness and optimism. The investigators noted that general feelings of happiness and optimism appeared to have a protective role against breast cancer in their sample (odds ratio [OR] = 0.75, 95% confidence interval [CI] = 0.64–0.86). These findings highlight the impact that psychosocial factors such as persistent stress and increased negative emotion can have on physical health, specifically, increasing the risk of cancer. Accordingly, interventions aimed at generating positive ATOA, which also affects stress, may similarly protect against cancer recurrence and promote survival.

Enhanced ATOA may also improve health maintenance practices, which in turn may promote cancer prevention. Compared to their younger counterparts, older adults, in general, are less likely to engage in preventive care including cancer screening, and exercise and nutrition interventions. Interestingly, research has suggested that older adults with a more positive ATOA are more likely to engage in preventive health behaviors such as eating a balanced diet, exercising, controlling alcohol consumption and smoking, and following directions for taking prescribed medications over the course of two decades (Levy & Myers, 2004). Accordingly, interventions to increase positive ATOA may support increased engagement in preventive care activities, consequently reducing cancer risk and recovery.

A few studies have explored interventions to improve ATOA specifically. In an innovative intervention targeting self-perceptions of aging and age stereotypes in adults over age 60, Levy, Pilver, Chung, and Slade (2014) found that an implicit-positive-age-stereotype intervention had a greater positive impact on self-perceptions of aging and age stereotypes, than an explicit-positive-age-stereotype intervention. Strengthening positive age stereotypes and self-perceptions of aging subsequently improved physical function over an extended period and had a greater impact than a 6-month-exercise intervention with a similar cohort. Similarly, in a randomized controlled trial of adults aged 65 and older, Wolff, Warner, Ziegelmann, and Wurm (2014) reported that older adults enrolled in a physical activity intervention that included a positive “views on aging” component, as well as a cognitive behavioral therapy technique to modify negative automatic thoughts in older adults, demonstrated increased positive ATOA compared to individuals enrolled in a physical activity only or volunteering group. In addition, recent research has also demonstrated that ATOA can be modified through the use of positive and negative “age primes” or messages, leading to better and worse, respectively, physical and cognitive performance (Meisner, 2012).

While the findings of the current study suggest that ATOA has positive health effects that are to some extent independent of resilience, interventions focused on increasing resilience to stressors, adversity, and health declines may have ancillary benefits in improving ATOA and have a positive relationship with cancer prevention. Similar to the interventions noted earlier, resilience and optimism interventions to increase ATOA should be centered around teaching participants how to challenge pessimistic beliefs, as well as techniques to alter their focus from more negative stimuli to more neutral or positive stimuli (Wolff et al., 2014). This can be accomplished through cognitive behavioral strategies that target and challenge a person’s negative view of aging and increase implicit and explicit positive views of aging.

Longitudinal studies are needed to better understand the effect of ATOA on health over time and as a foundation for clinical interventions to improve well-being and health in older adults, especially those with cancer. Future research

should examine the ability of ATOA to predict change in well-being among cancer survivors and other illness groups. Future studies should also explore mechanisms underlying the association of ATOA with mental and physical health. This would be best accomplished in randomized clinical trials. Clinical interventions to improve ATOA may lead to better physical and mental health in older adults and support primary and tertiary cancer prevention.

## Funding

This work was supported, in part, by the National Institute of Mental Health T32 Geriatric Mental Health Program MH019934 (PI: D. V. Jeste), and by the Sam and Rose Stein Institute for Research on Aging at University of California San Diego. This paper was published as part of a supplement sponsored and funded by the Centers for Disease Control and Prevention (CDC).

## Acknowledgments

We want to thank the reviewers for their valuable suggestions, which have undoubtedly made this a stronger manuscript.

*Author Contributions:* A. Martin: Helped design and implement the study, analyzed results, and helped prepare the manuscript; G. Eglit: Helped review the literature, analyze the results, and prepare the manuscript; Y. Maldonado: Helped implement the study and review the literature; R. Daly: Managed and analyzed data; J. Liu: Analyzed data; X. Tu: Designed plan for and supervised data analysis and helped prepare the manuscript; D. V. Jeste: Helped design the study, provided research supervision and support, and helped prepare the manuscript.

## Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

## Conflict of Interest

None reported.

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